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(71) Applicant(s)

Coinmaster Gaming Limited  
(Incorporated in the United Kingdom)

321 Penarth Road, CARDIFF, CF1 7TT, United Kingdom

(74) Agent and/or Address for Service

Urquhart-Dykes &amp; Lord

Three Trinity Court, 21-27 Newport Road, CARDIFF,  
CF24 0AA, United Kingdom

(72) Inventor(s)

Michael John Lerwill

(54) Abstract Title

Roulette apparatus with display

(57) A gaming apparatus comprising a wheel (2) mounted for rotation about its axis in a horizontal plane and formed with a reference aperture (18) connecting its upper and lower surfaces, a peripheral region of the upper surface of the wheel (2) being divided into a plurality of compartments (14). A first fixed-position sensor (42) is mounted below the wheel for detecting the reference aperture (18) as it passes overhead and a second fixed-position sensor (50) is arranged to detect whether a passing compartment of the wheel is occupied by a ball. The apparatus is arranged to count the number of compartments (14) passing the second sensor (50) in the time interval between the reference aperture (18) being detected by the first sensor (42) and an occupied compartment being detected by the second sensor (50), to determine therefrom the identify of the occupied compartment.

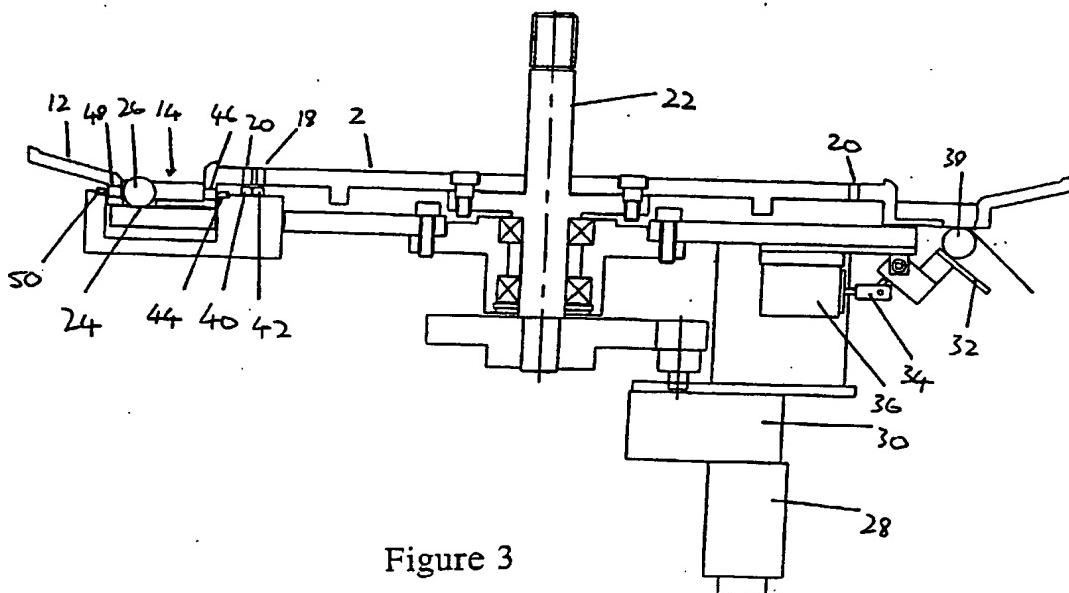


Figure 3

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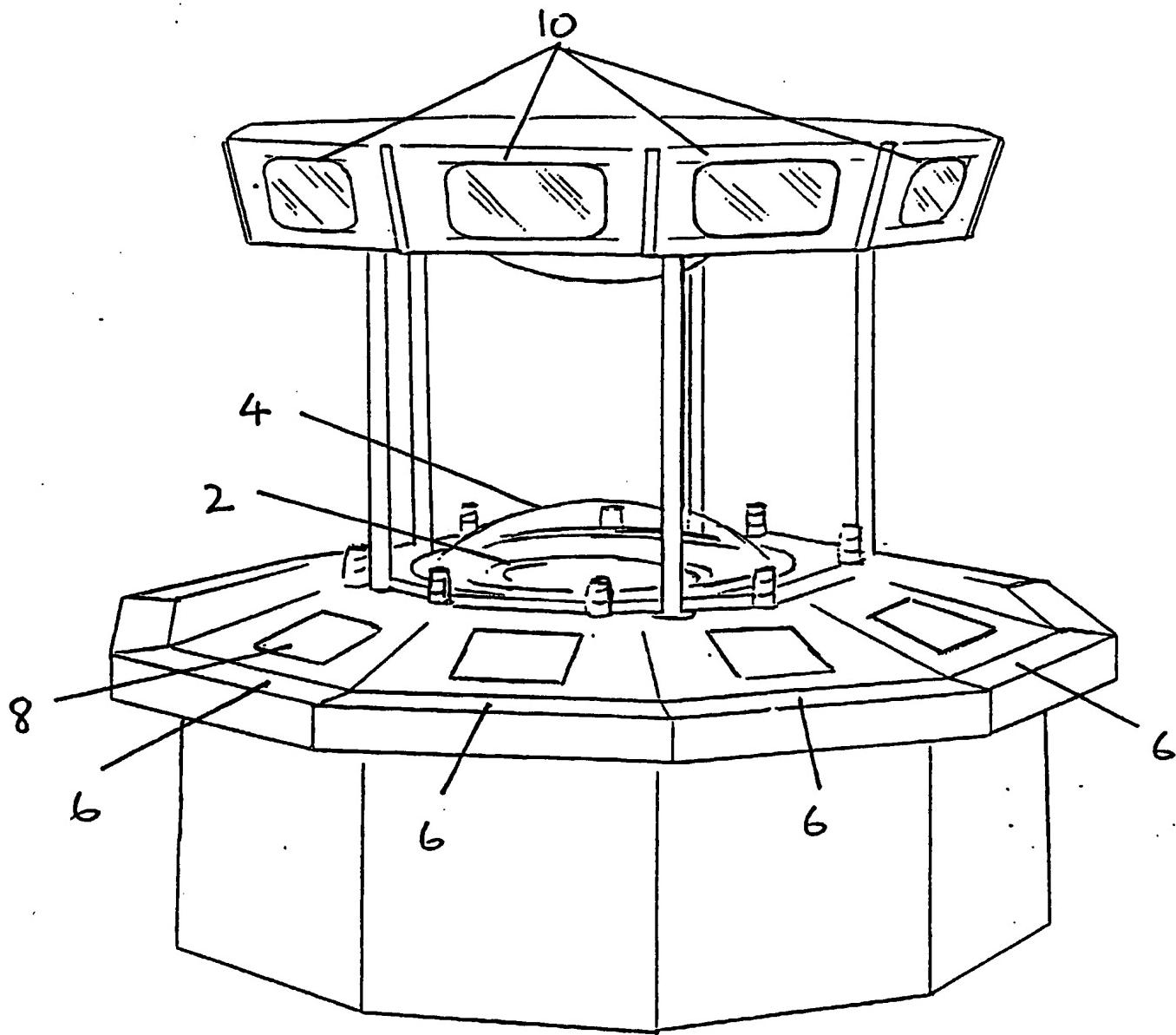


Figure 1

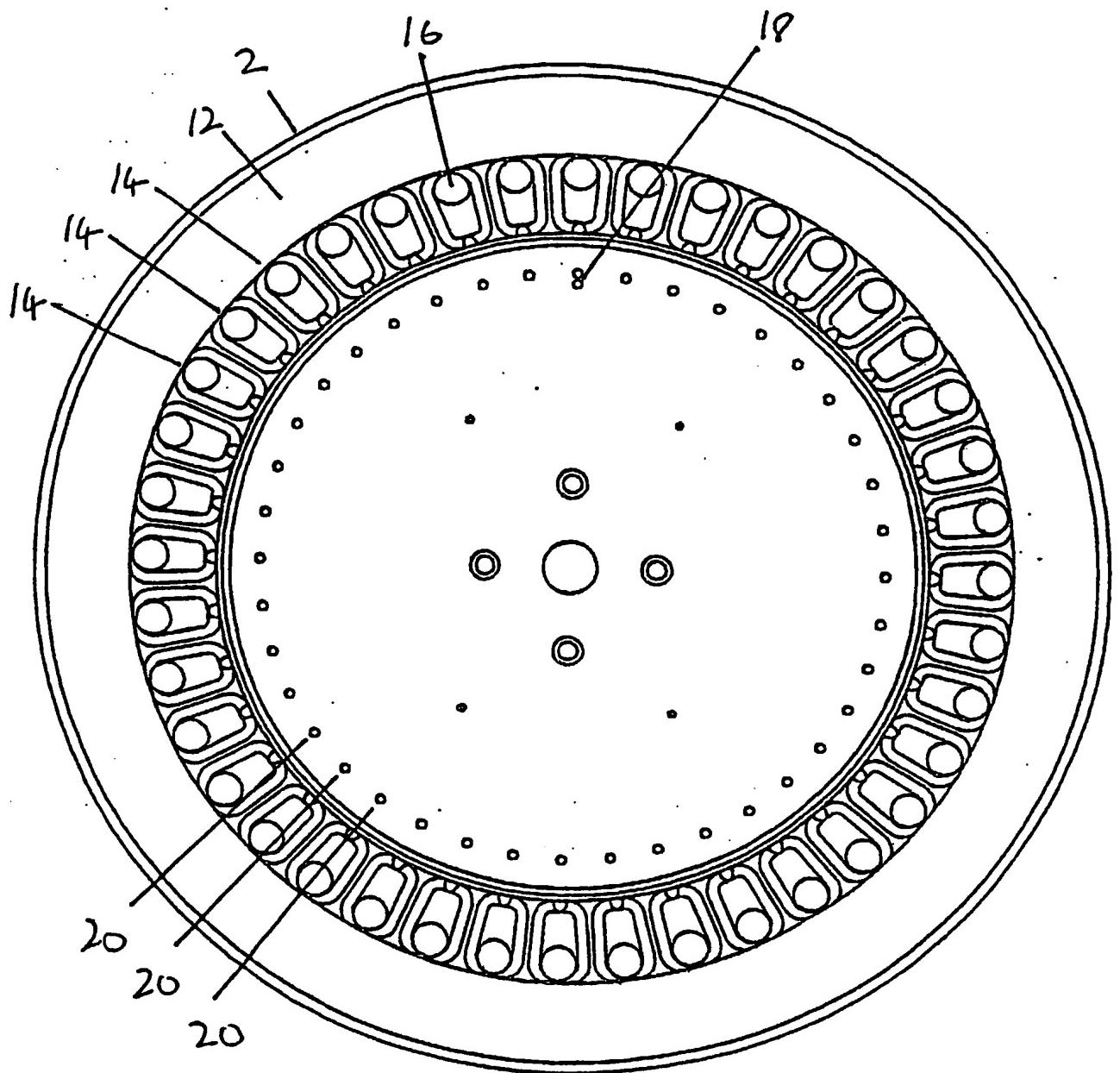


Figure 2

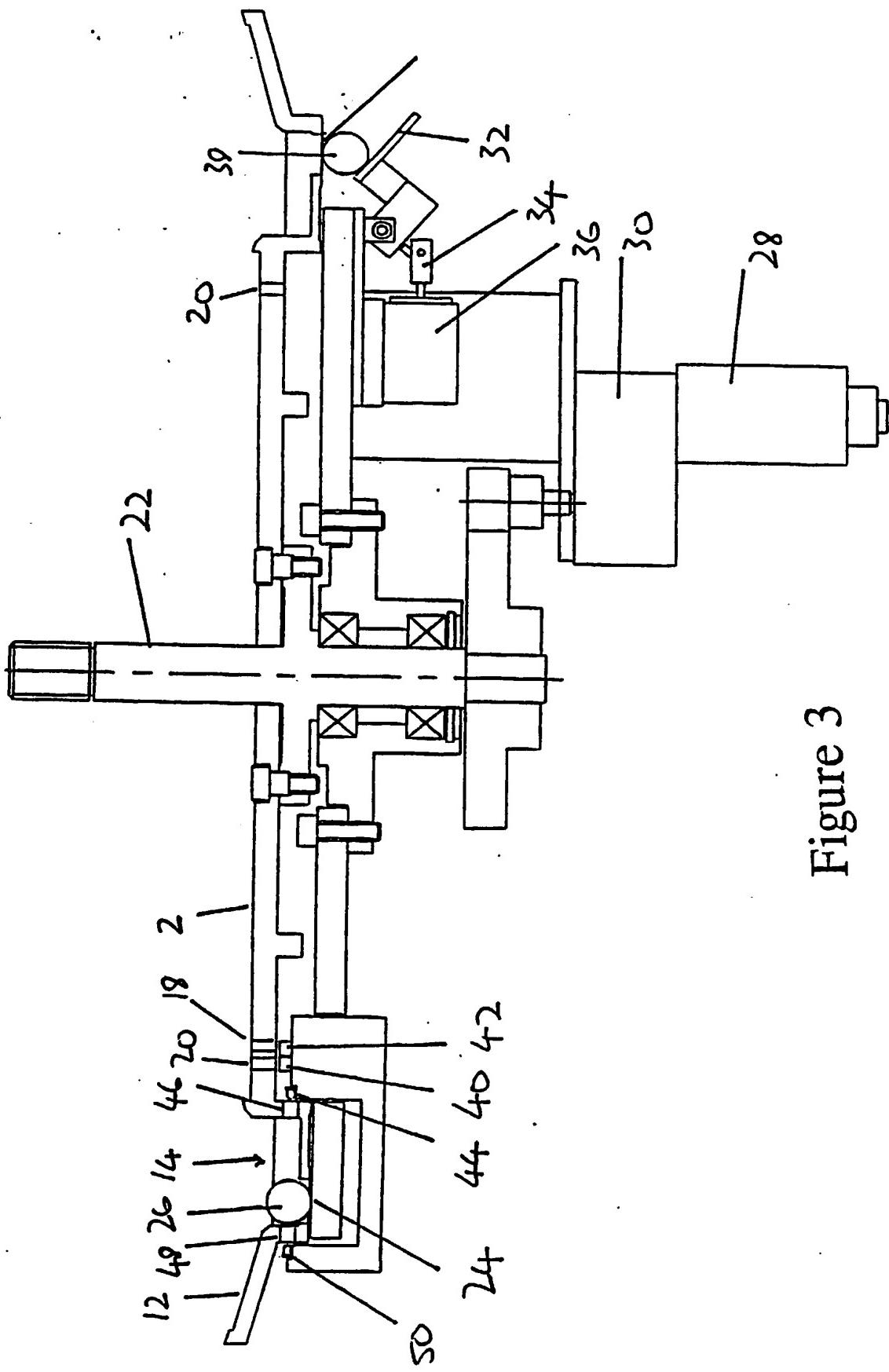


Figure 3

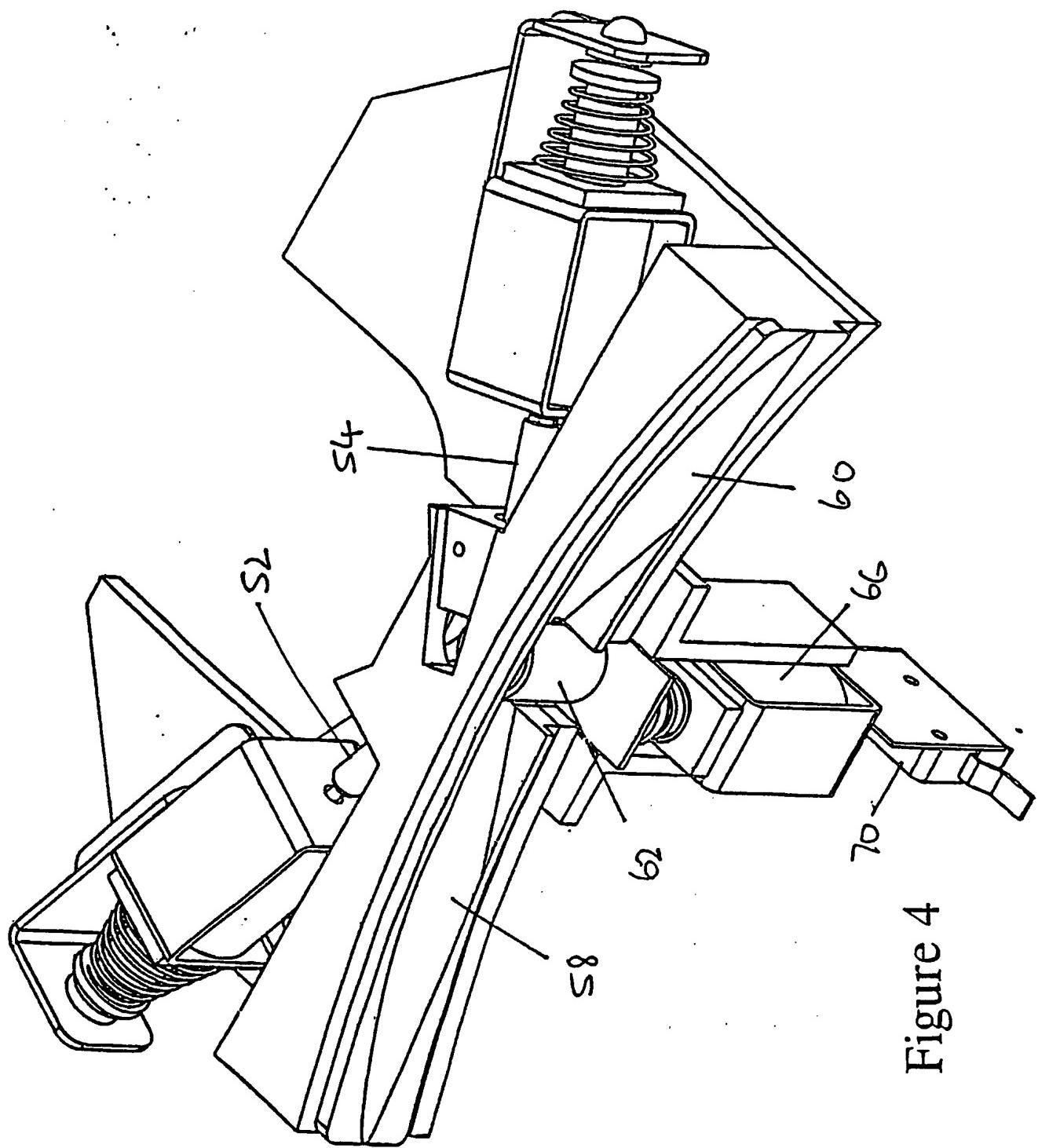


Figure 4

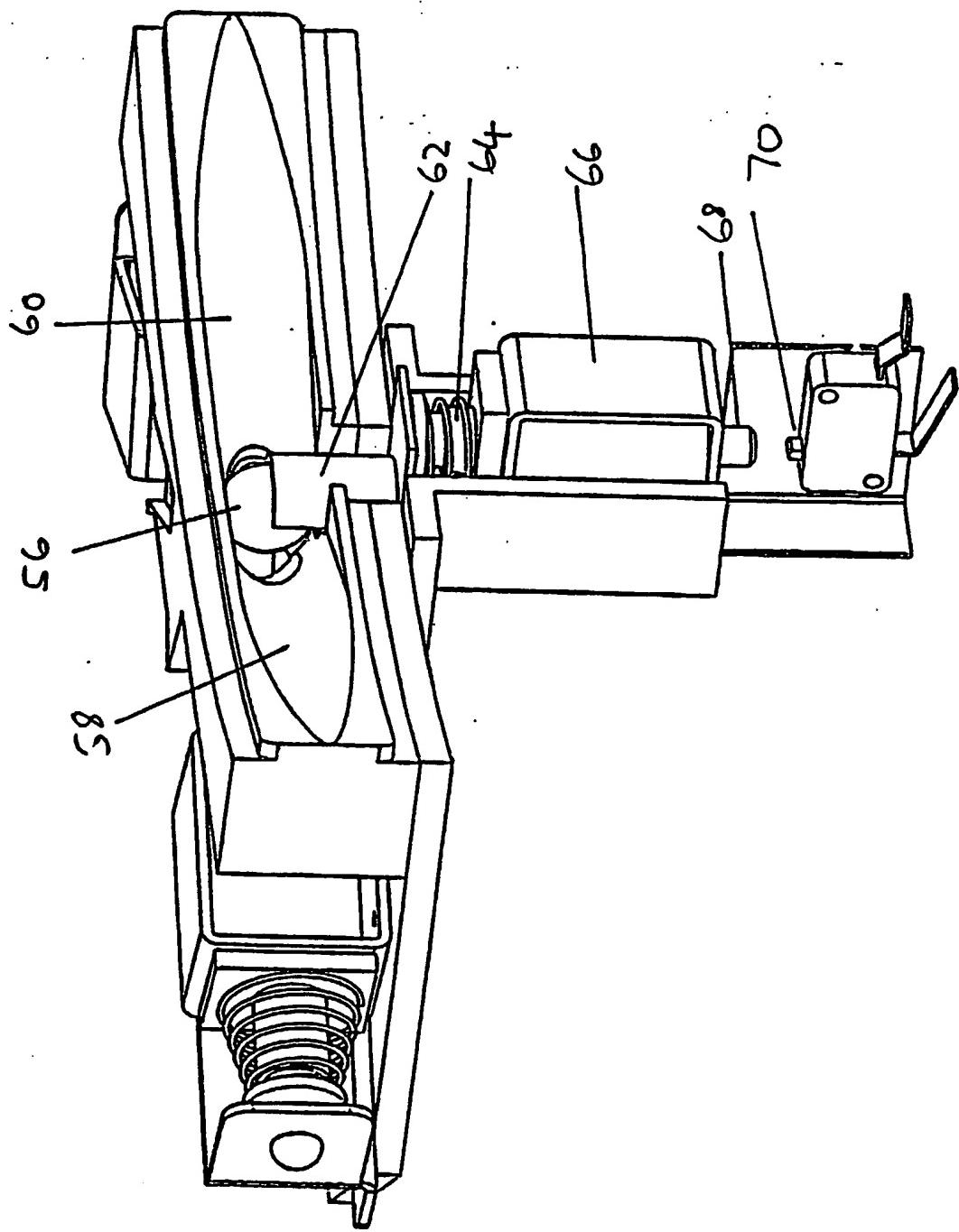


Figure 5

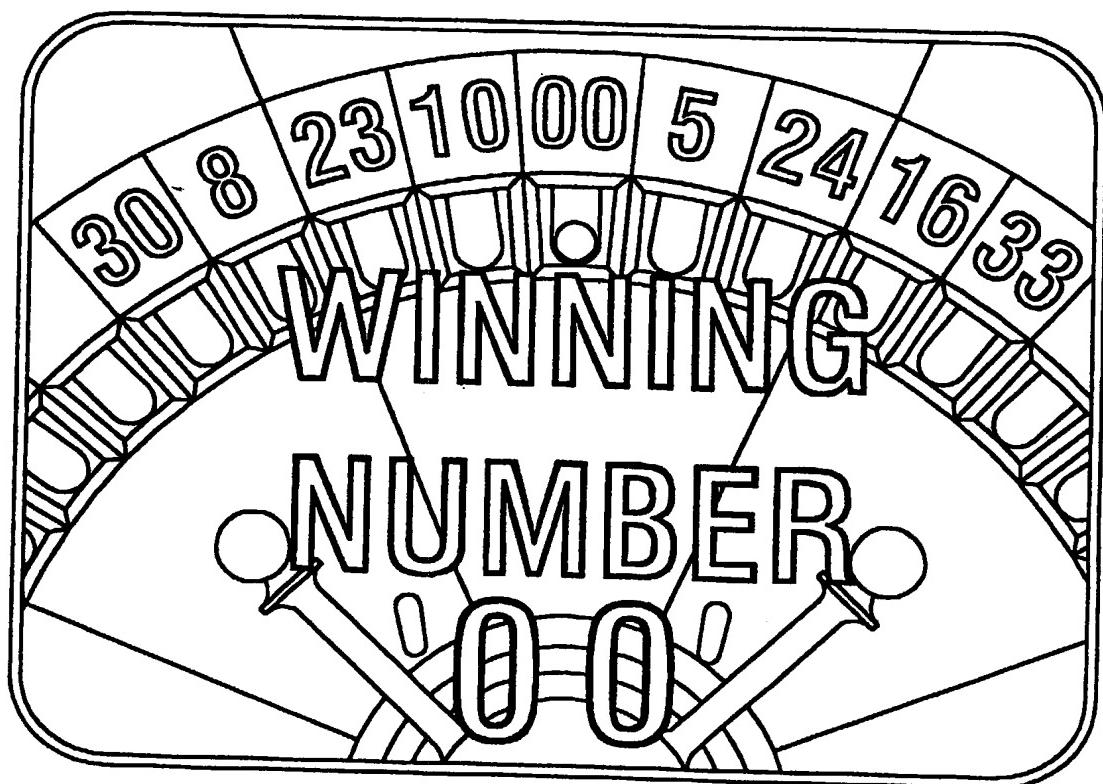


Figure 6

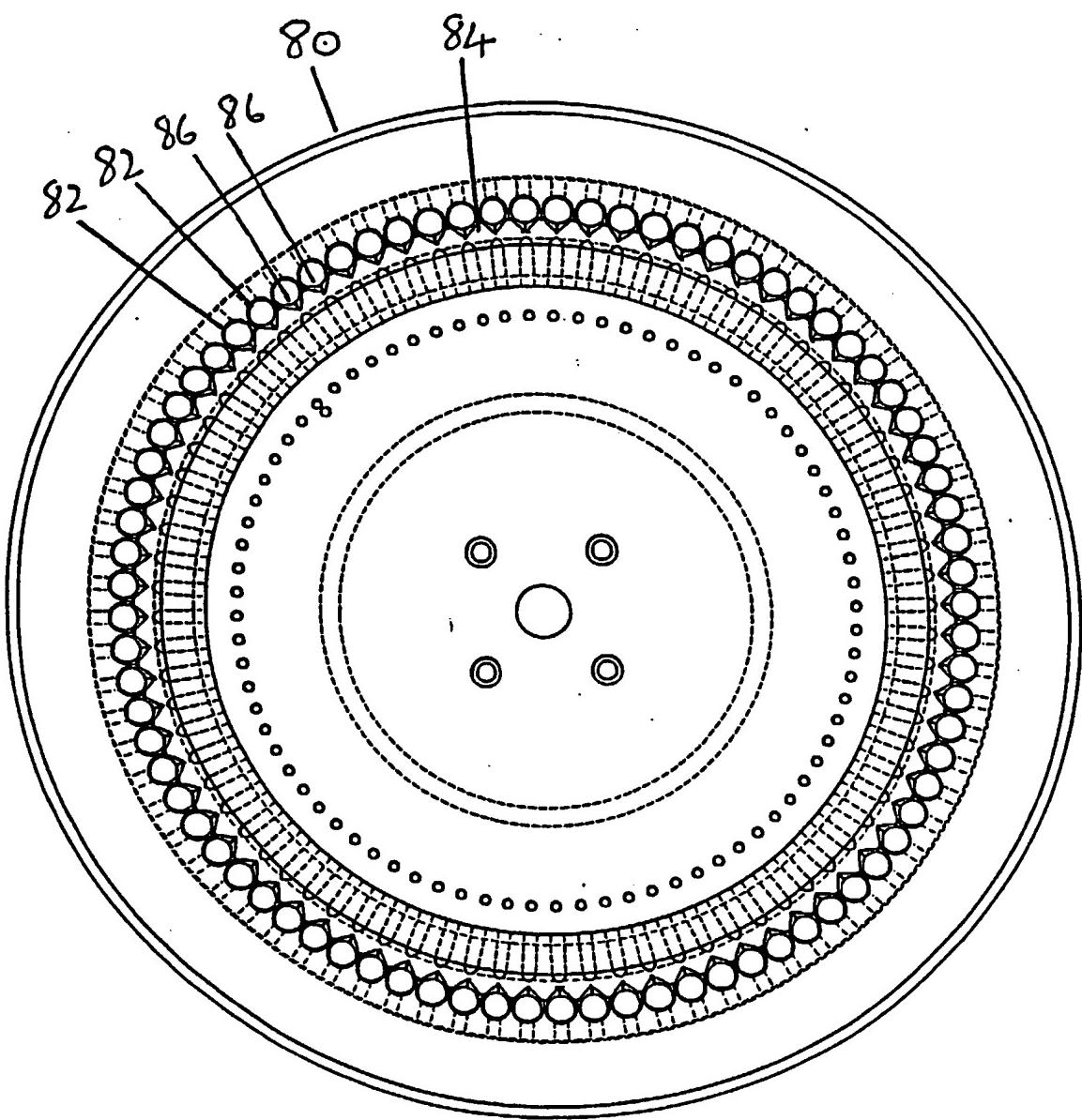


Figure 7

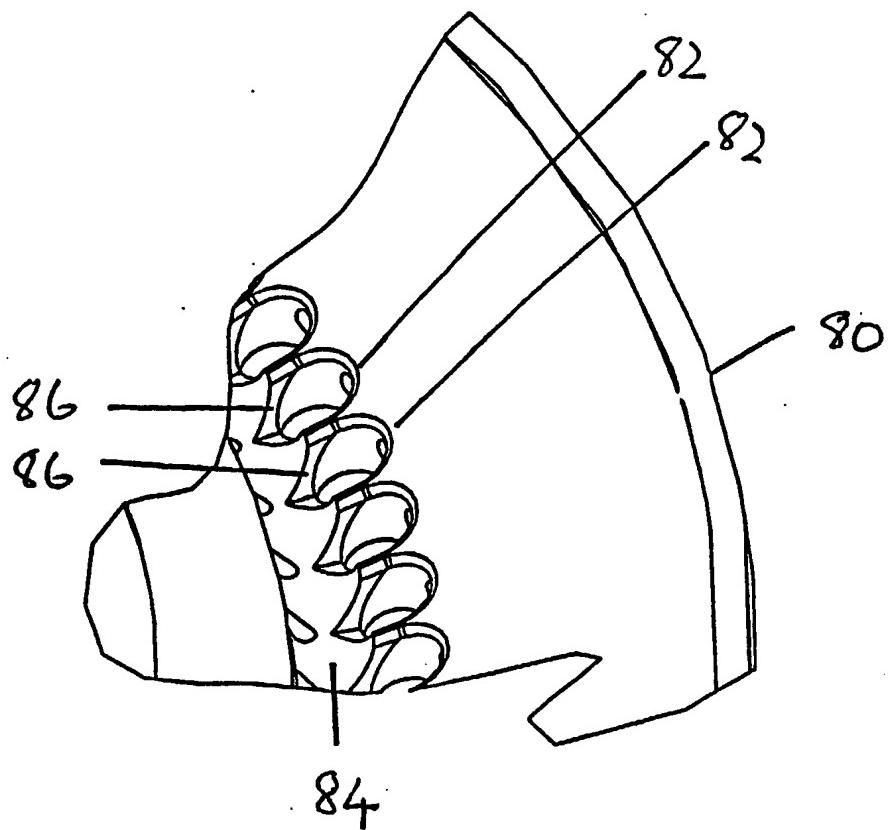


Figure 8

Gaming Apparatus

The present invention relates to a gaming apparatus and more particularly to a gaming apparatus based on the game of roulette.

The game of roulette has, for many years, provided 5 entertainment in casinos and other gaming establishments.

To play the game of roulette, a horizontally-oriented circular wheel, having a peripheral region divided into a plurality of numbered compartments, is spun in either a clockwise or an anti-clockwise direction about its axis. A ball 10 is released onto the surface of the spinning wheel where it is randomly deflected before eventually coming to rest in one or other of the compartments.

Players of the game bet on which compartment or subgroup of compartments the ball is going to fall into by 15 placing tokens or "chips" at appropriate locations on a betting table.

Traditionally, a croupier has been required to manually operate the roulette wheel and to supervise betting. However, with the advent of affordable electronic technology, it has now 20 become possible to provide a fully automated roulette wheel based gaming apparatus and a number of such systems are already in use.

In existing automated gaming apparatus, at least one-fixed position sensor is provided for detecting whether a 25 passing compartment of a roulette wheel is occupied by a ball. However, to determine the number associated with that compartment, it is necessary to establish the angular position of the wheel and we have now devised a cost effective arrangement by which this may be achieved.

30 In accordance with the present invention, there is provided a gaming apparatus comprising:

a wheel mounted for rotation about its axis in a

horizontal plane and formed with a reference aperture connecting its upper and lower surfaces, a peripheral region of the upper surface of the wheel being divided into a plurality of compartments;

5        a first fixed-position sensor mounted below the wheel for detecting the reference aperture as it passes overhead; and  
            a second fixed-position sensor for detecting whether a passing compartment of the wheel is occupied by a ball,

10      the apparatus being arranged to count the number of compartments passing the second sensor in the time interval between the reference aperture being detected by the first sensor and an occupied compartment being detected by the second sensor, to determine therefrom the identify of the occupied compartment.

15      The wheel is preferably formed with a circular arrangement of apertures connecting its upper and lower surfaces, each aperture corresponding with a respective compartment, the number of apertures detected by the first sensor (or by an additional sensor) in said time interval  
20 providing said count.

Under different international jurisdictions, the number of numbered compartments which must be provided by a roulette wheel can vary, thus requiring a manufacturer to produce a range of automatic gaming machines.

25      To overcome this limitation, the wheel of the present invention is preferably replaceable and the apparatus is arranged:

            to count the number of compartments of the wheel as the wheel is rotated;

30      and to automatically reconfigure itself, each time the wheel is replaced, according to the number of compartments counted.

In existing automated gaming apparatus, it is desirable for players to sit at respective consoles around a roulette  
35 wheel so that they are each able to watch the operation of the

wheel. However, this necessarily limits the number of people who can play the apparatus at any one time.

It is known to provide such an apparatus with a video camera which relays an image of the roulette wheel to the screen of one or more remote monitors, thus enabling an increased number of persons to play the apparatus. However, the image provided by a camera is typically of a very poor quality.

To overcome this limitation, the apparatus of the present invention is preferably arranged:

10 to identify which compartment of the wheel is occupied by a ball; and

to display a stored image corresponding to the compartment identified as being occupied.

The stored image is preferably a simulated image of the whole or a portion of the actual wheel, giving the player the impression that he is viewing the actual wheel of the apparatus. Preferably the simulated image is stored as a digitised image of an actual wheel. Preferably, whilst the ball is in play and before it comes to rest in a compartment, the 20 display means provides an animated display of a rotating wheel, which may comprise a sequence of digitised images of an actual wheel.

In existing automated gaming apparatus, the outcome of play is determined by identifying the compartment in which a 25 single ball comes to rest. However, this arrangement, which reflects the traditional rules of play of the game of roulette, is unnecessarily limited in the range of different bets that it can provide.

To overcome this limitation, the apparatus of the 30 present invention may be arranged:

to deliver a plurality of balls to the surface of the wheel;

to identify which of the compartments of the roulette wheel are simultaneously occupied by balls; and

35 to provide a payout according to the compartments

identified as being occupied.

Thus the apparatus may be used to play Keno or another such game.

A limitation of such an apparatus, particularly when 5 using a conventional roulette wheel, is that a ball coming to rest adjacent an already occupied compartment may become trapped and therefore fail to enter a compartment.

To overcome this limitation, the apparatus of the present invention preferably comprises at least one striker, 10 most preferably in the form of a swinging pendulum, positioned above the wheel, for dislodging any ball which may become trapped. Preferably the or each striker is arranged to deflect balls into unoccupied compartments of the wheel.

As an alternative or, more preferably, in addition to 15 providing the apparatus with one or more strikers, the wheel may be arranged for balls to enter the compartments thereof via a circular channel extending around the wheel and through respective entrance passages formed in the radially innermost edges of the compartments. Each compartment is sized to 20 accommodate a single ball so as to present a substantially smooth surface at its entrance from said channel, across which a ball may freely run. Where one or more strikers are provided, these preferably form obstructions in said channel.

An embodiment of the present invention will now be 25 described by way of an example only and with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of an automated gaming apparatus in accordance with the present invention;

Figure 2 is a plan view of the roulette wheel of the 30 gaming apparatus of Figure 1;

Figure 3 is a section through a sub-assembly of the apparatus;

Figures 4 and 5 are two different perspective views of the ball release sub-assembly of the apparatus;

35 Figure 6 is an example of a simulated screen display that might be provided by the apparatus;

Figure 7 is a plan view of a second embodiment of roulette wheel in accordance with the present invention; and

Figure 8 is a perspective view of a portion of the roulette wheel of Figure 7.

5 Referring to Figure 1 of the drawings, an automated roulette-wheel based gaming apparatus is shown comprising a roulette wheel 2 encased beneath a domed canopy 4, a plurality of operating consoles 6, each having a respective touch sensitive screen interface 8, and an elevated screen display  
10 10.

The roulette wheel 2 of the apparatus is shown in detail in Figure 2 and comprises an inclined peripheral region 12 encircling a plurality of compartments 14. The base of each compartment 14 is formed with an aperture 16 having a diameter  
15 slightly greater than that of the ball used to play the apparatus.

The wheel 2 is also formed with a reference aperture 18 and a circular arrangement of apertures 20, each corresponding with a respective compartment 14, the apertures 20 being used  
20 to determine the number corresponding with an occupied compartment, as will be explained in more detail below.

When the wheel 2 is fitted in place to an upright rotatable shaft 22, as shown in Figure 3, the apertures 16 of the compartments 14 overlie the static surface of an annular  
25 track 24 such that a ball, e.g. 26, coming to rest in one of the compartments will roll along the surface of the track 24 as the wheel 2 is rotated. The shaft 22 is rotated by an electric motor 28, which drives the shaft via a gearbox 30.

A portion 32 of the track 24 is pivotally mounted and  
30 connected to a solenoid or pneumatically operated plunger 34 such that when the plunger 34 is retracted by the solenoid 36, the pivotally mounted portion 32 is displaced away from the underside of the wheel 2 (as shown) to allow a ball, e.g. 38, carried in a compartment 14 passing over the pivotally mounted  
35 portion 32, to fall through the aperture 16 in the base of that compartment to be recovered.

As shown in Figure 3, a first optical sensor 40 mounted below the wheel 2 is arranged to detect the apertures 20 in the wheel 2 as they pass overhead. A second optical sensor 42 mounted adjacent the first sensor 40 is arranged to detect the reference aperture 18 of the wheel as it passes overhead. An optical transmitter 44 is arranged to transmit a light beam, through opposed apertures 46,48 formed respectively in the inner and outer walls of each compartment 14, to a third optical sensor 50, such that the beam is broken by a ball 10 sitting (as shown) in a passing compartment 14.

The arrangement of three optical sensors 40,42,50 allows the number corresponding to an occupied compartment to be determined by counting the number of apertures 20 to pass the first sensor 40 in the time interval between the reference aperture 18 being detected by the second sensor 42 and the occupied compartment being detected the third sensor 50.

The arrangement of optical sensors 40,42,50 also allows the apparatus to automatically reconfigure itself when the wheel 10 is replaced with one having a greater or lesser number 20 of compartments 14, by counting the number of apertures 20 detected by the first sensor 40 between successive detections of the reference aperture 18 by the second sensor 42.

A ball is delivered to the roulette wheel 2 by the arrangement shown in Figures 4 and 5 which is incorporated into 25 a circular wall surrounding the wheel 2.

The ball delivery arrangement comprises a pair of opposed spring-biased solenoid operated strikers 52,54, arranged to fire a ball, e.g. 56, along one or other of two oppositely-directed tangential delivery channels 58,60 and 30 around the periphery of the wheel 2. The direction in which the ball is fired for each play of the game is either pre-determined sequence or is chosen at random.

The solenoid operated strikers 52,54 are selectively operated by an electrical circuit (not shown) which varies, in 35 sequence or at random, the magnitude of the driving signal applied to the chosen solenoid.

The driving signal is provided by discharging a capacitor through the solenoid, the amount of charge stored by the capacitor thus determining the force with which the ball is struck.

5       The capacitor is charged from the output of a digital to analogue converter of the driving circuit, so that the amount of charge stored by the capacitor is determined by the digital value applied to the input of the converter.

A gate 62 is normally raised, to prevent a ball from  
10 being prematurely dislodged from its seat, but may be lowered for the ball to be delivered. The gate 62 is mounted to the spring-biased plunger 64 of a solenoid 66 for raising and lowering the gate. When the gate 62 is fully lowered, a portion 68 of the plunger 64 projecting from the base of the solenoid  
15 66 operates a microswitch 70, thereby causing the ball to be struck by one or other of the solenoid operated plungers 52, 54.

Referring once again to Figure 1, each screen of the elevated screen display 10 provides a display corresponding to the state of play of a game. When a ball is in play, but has  
20 not yet come to rest in a compartment 14, an animated digitised image of a roulette wheel is displayed. When the ball has come to rest in a compartment 14, an image such as that shown in Figure 6 is displayed to indicate the occupied compartment, as determined from the output of the optical sensors 40, 42, 50. The  
25 images displayed are such that a player viewing the screens will assume that he is looking at a relayed image of the roulette wheel 2 and not a simulated image. The elevated screen display 10 may also be used to present advertising or other information.

30       Whilst the apparatus described is intended primarily for use with a single ball to provide a single winning number, a plurality of balls might instead be released onto the surface of the wheel at each play, to provide a plurality of different winning numbers. In this case, an alternative, rapid fire ball  
35 delivery mechanism might be provided. For example the balls might be carried upwards by and thrown, one at a time, from the

top of a rotating Archimedean screw. Alternatively, a supply of pressurised air may be provided for blowing balls onto the surface of the wheel.

Where a number of balls are released onto the surface  
5 of the wheel at each play, it will be appreciated that any ball coming to rest adjacent an already occupied compartment may become trapped and therefore fail to enter a compartment.

Figures 7 and 8 shown an alternative embodiment of roulette wheel 80 which may be used to alleviate this problem.

10 The wheel of Figures 7 and 8 is arranged for balls to enter the compartments 82 thereof via a circular channel 84 and through respective entrance passages 86 formed in the radially innermost edges of the compartments. Each compartment 82 is sized to accommodate a single ball so as to present a  
15 substantially smooth surface at its entrance 86 from the channel 84, across which a ball may freely run.

One or more strikers in the form of swinging pendulums (not shown) are also mounted above the wheel, and form obstructions in the channel 84 for dislodging any ball which  
20 may become trapped. The incident surface of each striker is shaped to deflect balls from the channel into unoccupied compartments of the wheel.

The apparatus thus described provides a convenient means for determining the number associated with an occupied  
25 compartment of a roulette wheel.

Whilst typically the different compartments carry respective numbers to identify them, they may be identified by any other appropriate system of indicia. Also, whilst the apparatus has been described in the form of a roulette  
30 apparatus, it may be arranged to play any other game requiring a rotary wheel provided with a series of compartments to receive a ball released onto the wheel.

Claims

- 1) A gaming apparatus comprising:
  - a wheel mounted for rotation about its axis in a horizontal plane and formed with a reference aperture connecting its upper and lower surfaces, a peripheral region of the upper surface of the wheel being divided into a plurality of compartments;
  - a first fixed-position sensor mounted below the wheel for detecting the reference aperture as it passes overhead; and
  - 10 a second fixed-position sensor for detecting whether a passing compartment of the wheel is occupied by a ball, the apparatus being arranged to count the number of compartments passing the second sensor in the time interval between the reference aperture being detected by the first sensor and an occupied compartment being detected by the second sensor, to determine therefrom the identify of the occupied compartment, wherein the apparatus is arranged:
    - to identify which compartment of the wheel is occupied by a ball; and
    - 20 to display a stored image corresponding to the compartment identified as being occupied.
- 2) A gaming apparatus as claimed in Claim 1, wherein the stored image is a simulated image of the whole or a portion of the actual wheel, giving the player the impression that he is viewing the actual wheel of the apparatus.
- 3) A gaming apparatus as claimed in Claim 2, wherein the simulated image is stored as a digitised image of an actual wheel.
- 4) A gaming apparatus as claimed in any of Claims 1 to 3, 30 arranged such that, whilst the ball is in play and before it comes to rest in a compartment, the display comprises an animated display of a rotating wheel.

5) A gaming apparatus as claimed in Claim 4, wherein the animated display comprises a sequence of digitised images of an actual wheel.

**Claims**

- 1) A gaming apparatus comprising:  
a wheel mounted for rotation about its axis in a horizontal plane and formed with a reference aperture connecting its upper and lower surfaces, a peripheral region of the upper surface of the wheel being divided into a plurality of compartments;  
a first fixed-position sensor mounted below the wheel for detecting the reference aperture as it passes overhead; and  
10 a second fixed-position sensor for detecting whether a passing compartment of the wheel is occupied by a ball,  
the apparatus being arranged to count the number of compartments passing the second sensor in the time interval between the reference aperture being detected by the first sensor and an occupied compartment being detected by the second sensor, to determine therefrom the identify of the occupied compartment, wherein the apparatus is arranged:  
to identify which compartment of the wheel is occupied by a ball; and  
20 to display a stored image corresponding to the compartment identified as being occupied.
- 2) A gaming apparatus as claimed in Claim 1, wherein the stored image is a simulated image of the whole or a portion of the actual wheel, giving the player the impression that he is viewing the actual wheel of the apparatus.
- 3) A gaming apparatus as claimed in Claim 2, wherein the simulated image is stored as a digitised image of an actual wheel.

- 4) A gaming apparatus as claimed in any of Claims 1 to 3, arranged such that, whilst the ball is in play and before it comes to rest in a compartment, the display comprises an animated display of a rotating wheel.
- 5) A gaming apparatus as claimed in Claim 4, wherein the animated display comprises a sequence of digitised images of an actual wheel.



Application No: GB 0122343.7  
Claims searched: 1-5

Examiner: Mark Sexton  
Date of search: 15 October 2001

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:  
UK Cl (Ed.S): A6H (HJH, HJL); G4V (VAA, VHH); G1A AEAX  
Int Cl (Ed.7): A63F 5/00,02,04; G07F 17/34  
Other: Online: WPI, EPODOC, JAPIO

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
A	EP 0763374 A1 (SEGA ENTERPRISES)	
A	US 4396193 (REINHARDT ET AL.)	

- X Document indicating lack of novelty or inventive step  
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